AOARD REPORT

Networked Reality '94

May 13-14, 1994
T. Davis
AOARD

A summary of Networked Reality '94, the 1st International Workshop on Networked Reality in Telecommunication, conducted May 13-14, 1994 at the NTT Media Lab in Tokyo, Japan is presented. Abstracts of all presented papers are included, as is a complete list of workshop registrants. This report is based upon information collected via workshop attendance, review of the proceedings, and conversations with other attendees.

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1. Event Organization and Background.

Networked Reality '94, the 1st International Workshop on Networked Reality in Telecommunication, was conducted on May 13-14, 1994 at the NTT Media Lab in Tokyo, Japan. It was jointly sponsored by the IEEE Communications Society and IEICE, the Institute of Electronics, Information and Communication Engineers. As the event's full name suggests, it is envisioned as the first in a continuing series of workshops whose focus is the technology, services and also social/cultural issues associated with the next generation communications environment.

Dr. Takahiko Kamae served as the General Chair of NR '94. He is currently affiliated with Hewlett-Packard Laboratories, Japan, following his recent retirement from the NTT Human Interface Laboratories. His contact information is as follows.

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"Networked Reality" refers to the array of technologies and services involved in collecting a representation of reality at one location and using it to reconstruct an artificial representation of that reality at a remote location. The term encompasses transmission of the required information between the sites, and also includes the psychological, cultural and legal implications of introducing derived communications systems. Networked Reality is clearly derived from the emerging virtual reality technology base but is intended to go beyond the latter to include its integration with the required telecommunications technologies.

The NR '94 technical program was divided into eight distinct technical sessions, conducted serially over the two day workshop. The first seven technical sessions consisted of paper presentations (typically three or four papers, each of approximately thirty minutes duration, per session). Some of the presentations were accompanied by associated system demonstrations, located in two rooms adjacent to the meeting room and available during the break periods between program sessions. The workshop was concluded with a panel session. The program content of each session is briefly described in Section 2.

A noteworthy feature of the NR '94 technical program is the extent of emphasis on social (particularly medical) impacts of the subject technology. This is no doubt a consequence of the Japanese government's interest in and support of technology development with a quality of life focus.

NR '94 was attended by about 140 people. A complete list of event registrants, collected on site, is provided in Section 3. The list includes approximately 20 North American, six European and two non-Japanese Asian attendees, with the remaining attendees being Japanese. In keeping with the inclusion of social/cultural issues in the workshop focus, the legal, medical, financial and artistic disciplines are represented in both the list of registrants and the workshop program.

The NR '94 program was conducted in English, and English language versions of all workshop papers are available. Abstracts (or in some cases an introductory section) are collected in Section 4. In most cases, the authors' contact information is included.

As indicated in the opening paragraph of this section, NR '94 is envisioned as the first in a series of workshops devoted to Networked Reality. At the concluding session of NR '94, a tentative plan to conduct the second workshop in the United States in approximately 18 months (i.e. approximately November 1995) was announced. Mr. Steven B. Weinstein of NEC USA is the designated General Chair. His contact information is as follows.

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2. Technical Program Synopsis.

The NR '94 technical program began with a brief opening address by Dr. Kamae. His remarks were in the nature of a welcome to all attendees, introduction and acknowledgment of organizing committee members, acknowledgment of contributions from all supporting organizations and a brief review of how the event came into being.

Immediately after Dr. Kamae's opening remarks, the series of technical sessions commenced. Sessions 1-4 were conducted on the opening day of the workshop (13 May) and Sessions 5-8 on the second day (14 May). Following is a brief review of each session, including session name, general topic area and session highlights. The paper abstracts presented in Section 4 below are grouped according to these session numbers.

Session 1, titled Networked Reality Technology - Interface, consisted of four paper presentations. The first three presentations were all clearly connected to human interface research topics (the SPIDAR virtual space teleconferencing paper by Ishii, et. al. from Tokyo University, the Voicemail paper by Cohen from the University of Aizu and the VideoPeek user interface paper by Akutsu, et. al. from the NTT Human Interface Lab). However, the fourth presentation of the session (Mt. Fuji Project, by Fujihata) was a somewhat whimsical examination by an artist (with no technical background)

of how humans experience and translate between distance, time and speed. The "experiment" consisted of displaying camcorder video and GPS derived position information collected by the author on a climb to the peak of Mt. Fuji. No recognizable scientific method was employed in analyzing the data.

One of the papers in Session 1, the VideoPeek paper by Akutsu, et. al., was accompanied by a demonstration, which was available for examination during the session breaks.

At the conclusion of Session 1, a "virtual space teleconference" was conducted between the NR '94 meeting site and the Advanced Telecommunications Research Institute (ATR), located in the Kansai Science City near Kyoto, Japan. The teleconference was conducted using ATR's Virtual Space Teleconferencing demonstration system. This system is a product of one of ATR's flagship research projects, and is briefly described in AOARD-TR-94-19, The Advanced Telecommunications Research Institute (ATR).

Session 2 was one of two separate sessions titled Realizing Networked Reality (Session 6 was the other). It was composed of three presentations, two of which (the Cybercube Project paper by Dowden of Cybercube Research Corporation and the NPSNET paper by Pratt, et. al. of the U. S. Naval Postgraduate School) dealt with solving fundamental networked reality problems.

The Cybercube is a software application/interface designed to provide an efficient way of accessing and organizing a large amount of time based multimedia information in three dimensions. The NPSNET is a distributed simulation of large scale military vehicle operations. The associated presentation concerned feasible implementations of world consistency paradigms. Both the Cybercube and NPSNET presentations had associated demonstration systems available during session breaks.

The other presentation in Session 2, by Hirose, et. al. from the University of Tokyo, described a "virtual playground" system developed for the National Children's Hospital. The system is intended for use by hospitalized children whose range of activity is limited by their medical conditions.

Session 3, was titled Networked Reality Systems and featured three presentations, two virtual reality applications (Virtual Polis, by Loeffler of Carnegie Mellon University and Interspace, by Suguwara, et. al. of the NTT Human Interface Lab) and a networked virtual space implementation of the "Twister" parlor game, by Fujihata and Suzuki of Keio University.

The networked reality implementation of the Twister game consists of having human operators manipulate, via joysticks, tripedal clones of themselves in a virtual space equipped with a virtual "Twister" mat. The system was demonstrated on 18 February, 1994 by linking the site of IMAGINA '94 (Monte Carlo, France) with Keio University in Yokohama.

Both the Interspace and Twister Game presentations had associated demonstration systems available during session breaks.

Session 4, titled Networked Reality Technology - Processing, included three presentations, two involving video database access and/or processing (the fast scene cut detection paper by Nakajima of KDD R&D Labs and the structured

video processing paper by Hsu and Harashima of Tokyo University), and the third involving a design approach for standard network services, by Rhissa, et. al. of Institut National de Telecommunications in France. The latter paper was not presented due to absence of the authors. The two presented papers, the video processing papers by Nakajima and Hsu/Harashima, were by far the most academically rigorous presentations in the NR '94 technical program.

Session 5, titled Networked Reality and Human, began the second day of the workshop. It consisted of three presentations concerning human factors issues. The first presentation of the session (the paper by Igarashi, et. al., which was presented by Yamaguchi) reported a study of the level of fatigue experienced by subjects utilizing an on-line hospital system virtual environment called "Hyper Hospital". The Hyper Hospital is under development by the Japan Advanced Institute of Science and Technology, and was the subject of a Session 6 presentation as noted below. Dr. Yamaguchi was originally a medical doctor who later became a biomedical engineer, and the presentation reflected a rigorous biomedical experiment which included extensive measurement and analysis of physiological, neurological, biochemical and psychological fatigue indicators.

The presentation by Susuma, from the University of Tokyo, was essentially a catalogue of work on telepresence conducted in his own lab and arising from the eighties era national project "Advanced Robot Technology in Hazardous Environment". The presentation by Milgram, based on the paper by Milgram, et. al. from the Advanced Telecommunications Research Institute, proposed a new taxonomy for the apparently unrelated developments currently being pursued in the virtual reality development arena.

Session 6, was the second of two separate sessions titled Realizing Networked Reality (Session 2 was the first). The session was composed of three applications related presentations. The first presentation, the paper by Nakamura, et. al. from NEC, concerned a distributed work environment project. It is similar in nature to but apparently less developed than both the SPIDAR system presented by Ishii in Session 1 and the much more widely known ATR Virtual Space Teleconferencing project (mentioned above in the note concerning the virtual space teleconferencing experiment conducted during the break between Sessions 1 and 2).

The two remaining Session 6 presentations concerned more developed projects. One was the Rapport Multimedia Conference System, the subject of the paper by Seligmann and Edmark of AT&T Bell Labs, and the other was the Hyper Hospital project, under development by the Japan Advanced Institute of Science and Technology and described in the paper by Noritake, et. al. The Hyper Hospital project was alluded to earlier in connection with the Session 5 presentation by Yamaguchi.

The AT&T Rapport presentation had an associated demonstration system which was available during session breaks.

Session 7 was the final presentation session on the NR '94 technical program. It was titled Networked Reality Impacts on Society, and it consisted of four presentations. The first was an examination by Andia, et. al. from U. C. Berkeley of the impact on the Architecture/Engineering/Construction (AEC) industry, which, according to the authors accounts for 10% of the U. S. and

20% of the Japanese GDPs. The presentation by Yoshida of Kyoto Institute of Technology provided a somewhat whimsical view of a neo-human species called Cableans and their battle for existence. The presentation by Karnow, from the San Francisco law firm of Landels, Ripley and Diamond, presented a serious and imaginative look at the legal implications of society's looming reliance on synthetic worlds. The concluding paper by Ikeda, from the Dept. of Social Psychology at the University of Tokyo, examined some social psychological implications of Networked Reality.

Session 8 of the technical program was a panel session, titled Future Directions of Networked Reality -- Where the NR Goes. It was moderated by Dr. Kamae. The panelists were:

S. B. Weinstein (NEC, USA)
M. Hirose (University of Tokyo, JAPAN)
D. Seligmann (AT&T, USA)
Y. Tsukio (University of Tokyo, JAPAN)
Y. Saeki (University of Tokyo, JAPAN)
C. Loeffler (Carnegie Mellon University, USA)

The panel session identified the following list of issues with which the Networked Reality research community should be concerned for the foreseeable future: interoperability, semantic linkages, authentication, security, intellectual property, capacity, flexibility and business support.

3. Workshop Registrants.

Following is a complete list of NR '94 workshop registrants. The list was generated on site by the event administrators and is a very accurate reflection of actual event attendance.

Karduck Achim
Alonzo C. Addison
Akihito Akutsu
Isao Arima
Yuichi Baba
Michael Cohen
Howard Curtis
Derek J. Dowden
Masaki Fujihata
Volker Grassmuck
Hiroshi Harashima
Univ. of Freiburg, Gemany
UC Berkeley
NTT Human Interface Labs
NTT Data
University of Tokyo
University of Aizu
International Liaison Office
CyberCube Research Corp.
Keio University
Mediamarc (NL)
University of Tokyo
Yoshinori Hatori
Kenji Hayashi
Michitaka Hirose
Mildo lino
Kenichi Ikeda
Akihiro Inoue
Masahiro ISHII
Kazuo Itoh
Sumio Kadohira
Takahiko Kamae
Yuko Kashima
Yasuhisa Karo
Yuldko Kawai
Akihisa Kawanobe
Fumio Kishino
Koichi Kondo
Tetsuya Kusuda
Carl Eugene Loeffler
Tadao Maekawa
Hideo Maruyama
Michiaki Matsuura
Kenji Matsuyama
Paul Milgram

Hachizo Miyamoto	NEC
Machio Moriuchi	NTT Human Interface Labs.
Masataka Murata	University of Tokyo
Tsutomu Nagaoka	
Yasuyuki Nakajima	KDD R&D Labs.
Kazunari Nakane	Project ICC, NTT
Yutaka Nakazawa	Project ICC, NTT
Geoff Newman	Asia Pacific United Tech.
Jun Nishikido	NTT
Minoru Nishizaki	OKI Electric. Ind. Co. Ltd.
Kazuhiro Ohba	NTT Learning Systems
Hidenori Okuda	NTT Human Interface Labs.
Willie Png	National Univ. of Singapore
Philippe Queau	INA, France
Hermann Rodlet	Siemens K.K.
Hiyori Sakashita	SMN
Makoto Sato	Tokyo Inst. of Technology
D. D. Seligmann	AT&T Bell Laboratories
Kazunori Shimamura	NTT Human Interface Lab.
Roe Adams, III	
Kenichi Aihara	NTT
Allredo Andia	UC Berkeley
Hiroyuki Arita	NTT Human Interface Labs.
Nieolo Ceccarellio	Comunicazione
Douglas Cool	USAF
Tom Davis	AFOSR/AOARD
Takaya Endo	NTT Advanced Technology
Koichi Goto	Railway Tech.Research Inst.
Terno Hamano	NTT
Tomoyuld Hatanaka	Matsushita Electric Works
Kazuhiro Hayakawa	NTT Human Interface Lab.
KDD R&D Labs	
NTT Advertizing Inc	
University of Tokyo	
NTT Learning Systems	
University of Tokyo	
NTT Advanced Technology	
Tokyo Inst. of Technology	
Asahi Electronics Co, Ltd.	
NTT Advertizing Inc.	
HP Japan	
NTT Human Interface Lab.	
NTT	
NTT Advanced Technology	
NTT	
ATR Comunications Lab.	
Salomon Brothers	
NTT DATA	
Carnegie Mellon University	
NTT Human Interface Lab.	
NEC	
NTT Human Interface Labs	
Oki Electric Industry Co.	
ATR Communications Lab.	

Akira Hiraiwa	NTT Human Interface Labs.
P.R. Hsu	University of Tokyo
Kenichi Ikeda	University of Tokyo
Yasushi Ikei	Tokyo Metroplitan Inst.Tech.
Shirley Isakari	Naval Postgraduate School
Farhad Islam	NTT Human Interface Labs.
Takashi Izato	Taisei Corporation
David Kahaner	Naval Research Asian Office
Curtis E.A. Karnow	Landels, Ripley & Diamond
Toshihiro Kato	NTT Learning Systems
Takanori Kawai	Nippon RAD
Yasuyuld Kawaura	Yokohama City University
Tomio Kishimoto	NTT Human Interface Labs.
Motoko Kitamura	Canon Inc.
Takashi Kouno	NTT Human Interface Labs.
Ee-Taek Lee	ETRI, Korea
Kunihiro Maeda	NOVA Information Sys. Inc.
Masatoshi Maidno	NTT Transmissions Systems
Kenji Mase	NTT Human Interface Labs
Norihiko Matsuura	NTT Human Interface Labs
Marc McEachern	HP, Japan
Kenichi Minami	NTT Human Interface Labs
Tets Morita	Hitachi Maxell
Yumi Murakami	NTT Human Interface Labs
Toshio Nagafune	Obayashi Corporation
Yoshio Nagashima	NTT Human Interface Labs.
Nobutatsu Nakamura	NEC
Minoru Nakano	NTT Human Interface Labs.
Kenji Nakazawa	NTT Interdisc. Research
Kiyoshi Niki	Salomon Brothers
Ryosuke Nishino	University of Tokyo
J.Noritake	Tokai University
Ken-ichi Okada	Keio University
Tatsuo Oowada	Project ICC, NTT
David R. Pratt	Naval Postgraduate School
Cot Quist	KDD
Yutaka Saeki	University of Tokyo
Shinichi Sakuraya	Sony Corporation
Osamu Sekine	Matsushita Electric Works
Cyrus Shaoul	NTT Advanced Technology
Kazuhiko Shinozaki	Solidray Co. Ltd.
Steven Spear	University of Tokyo
Gen Suzuki	NTT Human Interface Labs.
Susumu Tachi	University of Tokyo
Akiko Takashima	NTT Advanced Technology
Noriko Takezaki	The Telecom Tribune
Yoshiharu Takizawa	NTT Learning Systems
Yasuhiro Tanaka	NTT Data
Hiroya Tanigawa	NTT Human Interface Labs.
Masaki Taniguchi	University of Tokyo
Y. Tonomura	NTT Human Interface Labs.
C. Venkatraman	Hewlette-Packard
Yoichi Watanabe	KINDEN Corporation
Danny Wilson	Hewlett-Packard

Atsuya Yoshida	Kyoto Inst. of Technology
Nobuhiro Yoshida	Kansai TSC, NTT
S. Zadounalsky	Matra Hachette Multimedia
Otoya Shirotsuka	NTT Data
Shouhei Sugawara	NTT Human Interface Labs.
Nobuya Suzuki	Keio University
Tomonori Takahashi	NTT Advanced Technology
Haruo Takemura	Nara Institute of Science and
Takahiro Takino	Mainichi Newspapers
Hideyuki Tamura	Canon Inc.
Youichi Kato	NTT Human Interface Labs.
Yukinobu Taniguchi	NTT Human Interface Labs.
N. Terashima	ATR
Yoshio Tsukio	University of Tokyo
Yayoi Ueyama	NTT Advanced Technology
Yuji Wada	Inst. for Future Technology
S.B. Weinstein	NEC America
Takami Yamaguchi	Tokai University
Atsuya Yoshida	Kyoto Inst. of Technology
Kei Yuasa	H P Laboratories

4. Abstracts of Presented Papers.

Following are abstracts (or in some cases, an introductory section) of all papers included in the NR'94 technical program. They are grouped according to technical session number and arranged in the order in which they appeared on the technical program. As noted in Section 2 above, all listed papers except the Session 4 entry by Rhissa, et. al. from Institut National des Telecoms, France were presented. Full length versions of all listed papers are available from AOARD.

Session 1: Networked Reality Technology - Interface

Networked Virtual Work Environment System SPIDAR
Masahiro Ishii, Masanori Nakata, and Makoto Sato
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Abstract

Tele-presence makes it possible to convene quickly a meeting of several people in different offices, cities, or continents. As a result, time otherwise spent in travel may be used more efficiently, and urgent matters may be considered quickly for timely action. The design should be a social activity - the interactions of individuals within groups and the relation of groups to one another. The communication needs of designers are increasing as their projects become more complex and design teams become distributed; the communications solutions available to designers may have profound changes on the way design is practiced. A virtual cooperative workspace for the design of 3D objects requires both tele-presence and virtual reality technologies; support to communication and manipulating virtual objects.

Putting Spatial Sound Into Voicemail
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Introduction

It is important to exploit sound as a vital communication channel for computer-human interfaces. Audio windowing is conceived of as a frontend, or user interface, to an audio system with a spatial sound backend. This paper surveys the ideas underlying audio windowing and describes a system investigating asynchronous applications of these ideas. Features of a GUI (graphical user interface) can be extended to support an audio windowing system, driving a spatial sound backend. Besides the reinterpretation of WIMP (window/icon/menu/pointing device) conventions to support audio window operations for synchronous sessions like teleconferences, extra features can be added to support asynchronous operations like voicemail. After tracing some underlying technology of audio imaging in computer-human interfaces, we describe of an audio windowing prototype, "MAW" (acronymic for multidimensional audio windows), an exocentric graphical mouse-based interface based on an extended model of free-field 2D spatial sound, used to augment voicemail.

VideoPeek:
An Intuitive Video Representation in Cyberspace
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Yukinobu TANIGUCHI and Kenichi MINAMI
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Abstract

We focus on video information and a methodology for video interfaces is discussed. We propose an interactive visual interface, called "VideoPeek", for micro-macro video viewing in Cyberspace. VideoPeek is based on structured video where essential video information is described and arranged for computer processing. The representation of a video is varied according to the difference between the subject matter of the video and the user's current interests. A video that has some association, but not close, with the user's interest is located, in Cyberspace, far from the user, and we can see only a key frame image representing the essential idea of the video, this is the macro view of the video. As we approach the video, the features of the key image are

replaced with more and more video frames which constitute the representative images of scenes in the video. By selecting the video, we see the actual video, this is the micro view. This interface, the micro-macro video viewer, offers us a brand new tool for information selection.

Mt. Fuji Project. Imperceptible object and abstraction of experience.

Masaki FUJIHATA
Keio University
Faculty of Environmental Information
April-1994

Concept:
The concept of time and distance is understandable. A distance is exchangable to the duration of time. And also, time is measured as a distance. People say "5 minuites walk to the station.". It is not tell a accurate distance between here to the station. The road is not always streight and flat. Empirically this "5 minuites distance" is certain distance for one's experience.

The speed is an abstract concept. If the speed is constant, people can not recognize their situation in moving. (As you know, the earth rotates once in a day and is also circulating on solar system.) Only the acceleration or deceleration of the speed make them conscious of their speed. This accelerated velocity is not visible, it is just recognizable by the function of our body sensor. It is the vailability of time and distance, theoretically it is exchangable to the scale of space.

Art is a kind transformation filter which transforms one's rare experience up to an expression. In the process of expression, the enhancement and deformation technique is effective for transferring the reality of experience. Classically, art has been made through the experienced filter. In this project, the deformed scale of the space(Mt. Fuji) is used for expressing the experience of climbing the mountain. I believe new technology serves us a chance to build a new type of filter for expression. New technology has a potentiality for visualizing such invisible concept.

Ideas for research:
In this project, I will try to exchange the speed and distance in visible status. Mt. Fuji was choosen for the source of image for transforming the form. Ordinarily "Mt. Fuji" is percepted only by an objective view. This view from outside mountain forms the shape of the mountain in our mind. But while we are climbing the mountain, we can not see the mountain itself. It is because we are already in a part of that mountain. The climber's experience does not suit with the image of the mountain's shape formed by the outside view.

Session 2: Realizing Networked Reality (1)

The CyberCube Project
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Development of a Prototype Three Dimensional Interface using a Cybernetic Process Language and Operating Environment for Mapping Complex Interactive Multimedia Information Environments and Navigating Immersive Networked Communications Space

Abstract

The intent of the CyberCube project is to develop prototypes of an interface for an operating environment and new communication system for shared information space created by computer-mediated networks. The system is a networked hypermedia interface useful in mapping and navigating in a complex immersive information universe. It develops a process-based language for interactive communications specific to networked information environments. The objective is the development of a system for the three-dimensional representation, referencing and manipulation of symbolic knowledge in large networked hypermedia information databases. The project methodology is to design and implement a prototype interface, process language, and operating environment as the fundamental building blocks for cyberspace.

The CyberCube is a software application and interface that provides an efficient way of accessing and organizing large amounts of time based multimedia information within three-dimensional space. It is based on the metaphor of a three-dimensional geometric spatial grid for the mapping, navigation, organization and retrieval of information. The CyberSystem operating environment itself is a network of symbols. The assumption is that language constituted in it's current form as static text creates navigational problems and is unsuitable for developing modes of thought and expression in virtual worlds. A cybernetic or process based language becomes a necessity, such a language could be constituted of CyberSymbols which are constituted of any combination of digital media.

There are a variety of social, commercial and cultural applications for the system. It can be used as a production tool for the creation of stand-alone interactive hypermedia productions and artworks; a telecommunications interface for multimedia conferencing and personal messaging systems; an interface for visualisation, navigation and retrieval in large multimedia databases; and for developing networked and collaborative virtual environments for work, play, education, creativity and communications.

Virtual Playground and Communication Environments for Children
Michitaka Hirose* Masaaki Taniguchi* Yoshiyuki Nakagaki*
Kenzi Nihei* [* Department of Mechano-Infomatics Engineering, University of
Tokyo]

Abstract

We have developed the "Virtual Playground", which provides virtual playground and virtual visiting areas for hospitalized children. A Virtual Playground system is composed of TV monitors, joysticks, cameras, video transmission devices, and an extensive computer graphics workstation. In a Virtual Playground enviromnent, children can experience what is impossible or difficult during their stay in a hospital. We have completed a couple of experiments already and discussed its effectsl. In our recent work, we axe trying to introduce our simple version of the Cave system to the Virtual Playground system.

NPSNET:
Ensuring World Consistency in a Shared Networked Virtual Environment
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Naval Postgraduate School
Monterey, California, USA 93943
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The Department of Computer Science, Naval Postgraduate School, has been researching shared environments for four years. We have used both proprietary and community standard protocols to link networked players in a shared virtual environment. In this paper, we describe the implementation of two protocol suites and the fundamental problem of maintaining a consistent world representation between players. We examine the issues of entity location, orientation, status and velocity, network loading, and entity movement routines. Unlike many other papers in this area, we base our results on implemented virtual environments rather than theory alone.

Session 3: Networked Reality Systems

Virtual Polis: A Networked Virtual Reality Application
Carl Eugene Loeffler (Carnegie Mellon Univ, Pittsburg PA)

The Virtual Polls: Overview

The Virtual Polls - or city -is a virtual reality application consisting of a three dimensional, computer generated city, inhabited by a multitude of participants. They are joined together in the environment by means of telecommunications, and tele-existence is an essential aspect. Imagine a virtual city complete with people, private homes, museums, parks, stores, and entertainment centers. As much as a grand social experiment, the virtual city is also a far reaching graphical user interface (GUI) for cultural expression, electronic home shopping and entertainment, with implications for society as a whole. What sounds like science fiction is no longer so. One could largely exist in the simulacrum, conducting day to day activities from play to work.

InterSpace
-Networked Virtual World for Visual Communication-
Shohei SUGAWARA, Gen SUZUKI, Yoshio NAGASHIMA,
Michiaki MATSUURA, Hiroya TANIGAWA, and Machio MORIUCHI
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Introduction

Today, many systems are using virtual reality (VR) technologies as their user interfaces. Most of the systems are stand-alone "virtual world" simulators. Some systems (Habitat 1, SIMNET 2 and DIVE 3) were developed to construct multi-user shared virtual worlds for entertainment, training and collaborative working. These systems use the sensation of total immersion asa the basic user interface. The virtual world of these systems has no relation to the real world. The virtual world is the system specific ideal model of the real world. Users communicate within and feel totally immersed the computer generated virtual world. This paper describes the many-user networked virtual world system "InterSpace." InterSpace uses VR technology as the user-interface medium, but the system's main purpose is to enhance the user's communication activities.

TwisterGame on Network
by Masaki FUJIHATA, Nobuya Suzuki
Keio University, Faculty of Environmental Information
April-1994

Aim and condition:

1: Experimentation for connecting 2 different places by an electrical network, using telephone line with modem.

2: A collaboratation in one virtual place where participant will arise through the network. They are remotely connected from their own place. Each participant will share same experience in this virtual place.

3: To examine and construct the rule based framework for sharing an experience.

Session 4: Networked Reality Technology - Processing

A Fast Scene Cut Detection for an Efficient Networked Video Database Access
Yasuyuki Nakajima
KDD R&D Labs.
Kamifukuoka, Saitama Japan 356

Abstract

In this paper a video browsing using fast cut detection for networked video database access is described. The scene change frame is detected from the compressed video by using interframe luminance difference and chrominance correlation. The detected scene change frames are further investigated to exploit the relationship between the scenes and are classified in order to make a hierarchical indexing. These results of detection are stored as an scene index file using the MPEG format. The simulation results are also presented for several test video sequences to show that these methods have enabled the efficient video database construction and accessing.

PROCESSING OF STRUCTURED VIDEO IN MULTIMEDIA DATABASES

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1. INTRODUCTION

Over the last decade the rapid development of devices for image compression and data storage have brought about many applications of digital imaging. Often these applications, such as interactive video or real-image virtual reality, need to have these capabilities: 1) retrieving a large amount of images from the computer or a central image library; 2) visualizing a complex scene from any arbitrary viewpoint using real images. These capabilities will be very useful for evaluation, design and training in virtual environments, such as those employed in CAD, virtual reality, medical surgery or interactive video games.

This paper presents several image processing techniques for realizing video retrieval and real image-based visualization. For video retrieval, we describe an automated approach to detecting scene changes and activities which are meaningful to the user. We show that scene changes and activities may be treated as as a collection of motion discontinuities, and discuss how this formulation can be used to segment video streams into semantic video clips. These video clips are compactly expressible using a small set of words such as slow rotation, red color or circular cone.

For real image-based visualization, we present a novel approach for interpolating images captured at adjacent viewpoints without using 3-D structure information. The key insight is that no matter where a camera roams about a scene, for any particular feature, the lines of sight, from the camera's principal point through that feature in space all intersect at the feature. From mathematical duality, the duals of these lines of sight lie along a feature trajectory whose dual is the scene point. Coupling this duality with several constraints imposed on the image acquisition process, intermediate views can be generated from adjacent views by interpolating lines of sight along the feature trajectories.

DESIGN OF STANDARD NETWORK MANAGEMENT SERVICES USING OBJECT ORIENTED APPROACH

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ABSTRACT

Network management faces an urgent need for managing a wide variety of network resources in diverse forms. A general management system of heterogeneous networks has to respond to three requirements: 1) a unified global network information model, 2) interoperation between different

systems, 3) integration of all the network resources and applications. In this paper we will study the OSI information model and an open management platform for managing heterogeneous networks, introduce an application of heterogeneous network management developed by our research team which designs and implements standard services by using object-oriented concepts, taking into account that in an heterogeneous environment, component management systems lead to a great variety of management tools that differ largely in functionality and usage.

Session 5: Networked Reality and Human

IS THE VIRTUAL REALITY A GENTLE TECHNOLOGY FOR HUMANS?
-AN EXPERIMENTAL STUDY OF THE SAFETY FEATURES
OF A VIRTUAL REALITY SYSTEM-

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ABSTRACT

We are studying a novel concept of the on-line hospital system using a virtual environment called "Hyper Hospital". The "Hyper Hospital" is a medical care system which is constructed in a distributed manner to the electronic information network using virtual reality (VR) as a human interface. In the present report, we studied the physiological and psychological responses of healthy subjects induced by the usage of the VR in terms of fatigue. Twenty healthy young male subjects were exposed to the virtual reality system and they performed some psychological tasks with a virtual nurse for 30 minutes. Several parameters of physiological, psychological, and subjective fatigue were measured. None of the physiological or psychological parameters such as urinary catecholamine release, ECG, etc showed significant fatigue induced by our VR system. However, by using a standard questionnaire, some kinds of subjective fatigue were noted and they were thought to be indicating a direction of improvement for our VR system.

Networked Teleexistence

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Abstract

Virtual reality is a technology which presents a human being a sensation of being involved in a realistic virtual environment other than the environment where he or she really exists, and can interact with the virtual environment. Teleexistence is a concept named for the technology which enables a human being to have a real time sensation of being at the place other than the place where he or she actually exists. He or she can teleexist in the transmitted real world where the robot exists generated, It is possible to teleexist in a combined environment of transmitted and synthesized. Thus teleexistence and virtual reality are essentially the same technology expressed in different manners. In this paper, networked teleexistence system as the ultimate tool for communication, control, creation, entertainment, experience, and elucidation (3C's and 3E's) is reported.

MERGING REAL AND VIRTUAL WORLDS

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ABSTRACT

As the term Augmented Reality sees increasing usage in the context of merging real and virtual worlds within a single display, it is important to realise that not everyone means the same thing when they use the term. We propose a more general term, "Mixed Reality", which encompasses Augmented Reality, and which defines a number of potentially very useful display options, some of which are already being applied in practice. In order to distinguish between the conceptual and technical properties of various Mixed Reality implementations, a taxonomy is proposed in this paper. Although the number of distinguishing factors is potentially large, for the sake of parsimony the number of basis dimensions of the proposed taxonomy has been kept to three: Reproduction Fidelity/Trueness, Extent of World Knowledge, and Extent of Presence Metaphor. The reasoning behind this division is discussed and details of the taxonomy are presented.

Session 6: Realizing Networked Reality (2)

Distributed Virtual Environment System for Cooperative Work

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Abstract

This paper describes a distributed virtual environment system for cooperative works among the multiple users on the distributed computers connected via network. To realize the system, three techniques has been developed: 1) Server/client communication method among the distributed computers, 2) Management mechanism for virtual objects commonly used by multiple users to keep the virtual world consistency, 3) Multi-process model for various system configurations. The system enables the cooperative works on the distributed computers in various application areas.

User-Interface Mechanisms for Assurances During Multimedia Multiparty
Communication

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Abstract

As the complexity of multimedia systems and services increases, so does the difficulty for their users to assess, with some degree of certainty, the current state of these services and interaction. For example, a participant in a conference call may be uncertain of the parties present or even the identity of the speaker. Similarly, a user viewing displays of a shared application program may be uncertain that his or her view is the same as everyone else's.

In this paper, we analyze different types of assurances that systems can provide for users regarding the state of connectivity and focus in multimedia communication, and we discuss how media services can be used to provide assurances for each other. We also describe how the Meeting Room (MR) architecture (on which our virtual meeting room service, Rapport is built) enables media services to provide users with information and reinforced associations so that they can be assured of the status of the connectivity and interaction.

THE HYPER HOSPITAL -A NETWORKED REALITY BASED MEDICAL CARE SYSTEM-

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ABSTRACT

In the modern hospital, the medical therapeutic procedure is regarded as paramount and psychological or spiritual care is quite frequently put aside. The goal of the "Hyper Hospital" is to correct this. The Hyper Hospital, is constructed in the computer based electronic network using an alternate reality system, such as the virtual reality system, as the human-machine-human interface. The Hyper Hospital will be designed as a distributed system on the network, nodes of which belong to a patient and also to a variety of medical care facilities; for example, the out patient office, the nursing care center, the medical examination unit, the operating theater, etc. The Hyper Hospital space consists of various kind of spaces including the alternate reality space owned and exclusively controlled by the patient himself or herself, and even the real space as well. Most of the physical contact, such as the visit to the out patient office by the patient, is actualizod by the electronic connection of the patient private space and the public space of the hospital system. Prescription drugs, special care, and even the admission to the ward will be integrated into the distributed electronic network. To realize such a system, we need to solve many problems, such as the research on the network oriented architecture of the alternate reality, the development of human-machine interface particularly fitted to various disabilities, the study of the behavior of normal and diseased people, etc. The concept of the Hyper Hospital we are proposing is believed to be a new paradigm of the next generation of medical care.

Session 7: Networked Reality Impacts on Society

NETWORKED REALITIES IN THE AEC INDUSTRY:
The Cultural, Technological and Organizational Challenges Facing the US and Japan

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ABSTRACT

Although the Architecture/Engineering/Construction (AEC) industry today accounts for approximately ten percent of the US, and twenty percent of the Japanese GNPs, it remains one of the world's most technologically-backward fields. Despite many years of experimentation with information technologies (from computer graphics to word processing), the majority of AEC professionals still work by traditional means. The advances of the global society and formation of new industrial structures are increasing the complexity of design, construction, and management at an alarming rate, threatening current work processes and thus the viability of this entire industry.

HOW THE HUMAN BEING SURVIVES IN AN ON-LINE VIRTUAL WORLD
An Information Ethological Study of Human Behaviors in the Electronic Society

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CABLEAN EMERGED

At dawn on May 14 1994, an individual whose race, gender, age, national origin and physical appearance are not apparent has emerged. It is a Cablean, a neo-human who lives in a electronically formed on-line virtual world and moves through optical fiber cables or the waves being transmitted between parabolic antennas. The Cablean, when it is in our real world, always carries a book computer as a terminal, and always takes great care to find the location of the box to connect a modem with a telephone line. Who is he/she?

Nowadays, the progress in the electronic information technology is so rapid that it seems to accelerate the evolution and modification of human beings concerning communication behavior. The Cablean might be a modern day creature.

Information Loss and Implicit Error In Complex Modeling Machines

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A. Introduction

High end networked computers, and those required to run interactive virtual reality environments, have inherent characteristics which may produce inaccurate results. "Inaccurate" in this context means discrepancy in the comparison of computer or virtual worlds as compared to (i) physical reality or (ii) direct mathematical calculation.

Complex modeling machines primarily are used (a) to generate interactive computer-mediated or synthetic environments and (b) for high-end scientific modeling. These applications require, in brief, (i) high speed hardware architecture, generally using a form of parallel processing, and (ii) a multi-layered hierarchical architecture implemented in software. There are interesting consequences stemming from both the parallel processing and concomitant hierarchical processing paradigms.

A SOCIAL PSYCHOLOGICAL APPROACH TO THE NETWORKED REALITY

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1. VIRTUAL SOCIETY

"Networking", or formation of electronic virtual society through computer communication is, at the moment, realized only by erasing most of social and physical Constraints in our real world. It is realized with lots of difficulties. "Networkers" are facing with several psychological coping tasks, i.e. coping with the lack of nonverbal and/or social cues due to the media characteristics, and with the difficulties to develop "person schemata" on other networking members never met face-to-face. The success in these coping tasks enable us to construct our sense of "virtual society", that is, the sense of reality we are living in this virtuality. In order to analyze social-psychological aspects of this society, we have carried out a content analysis on electronic conferences and a randomsampled questionnaire survey on networkers. Here, howerver, I limit the discussion to the former. It will elucidate what are the communicative or psychological strategies to realize "the virtual society".
